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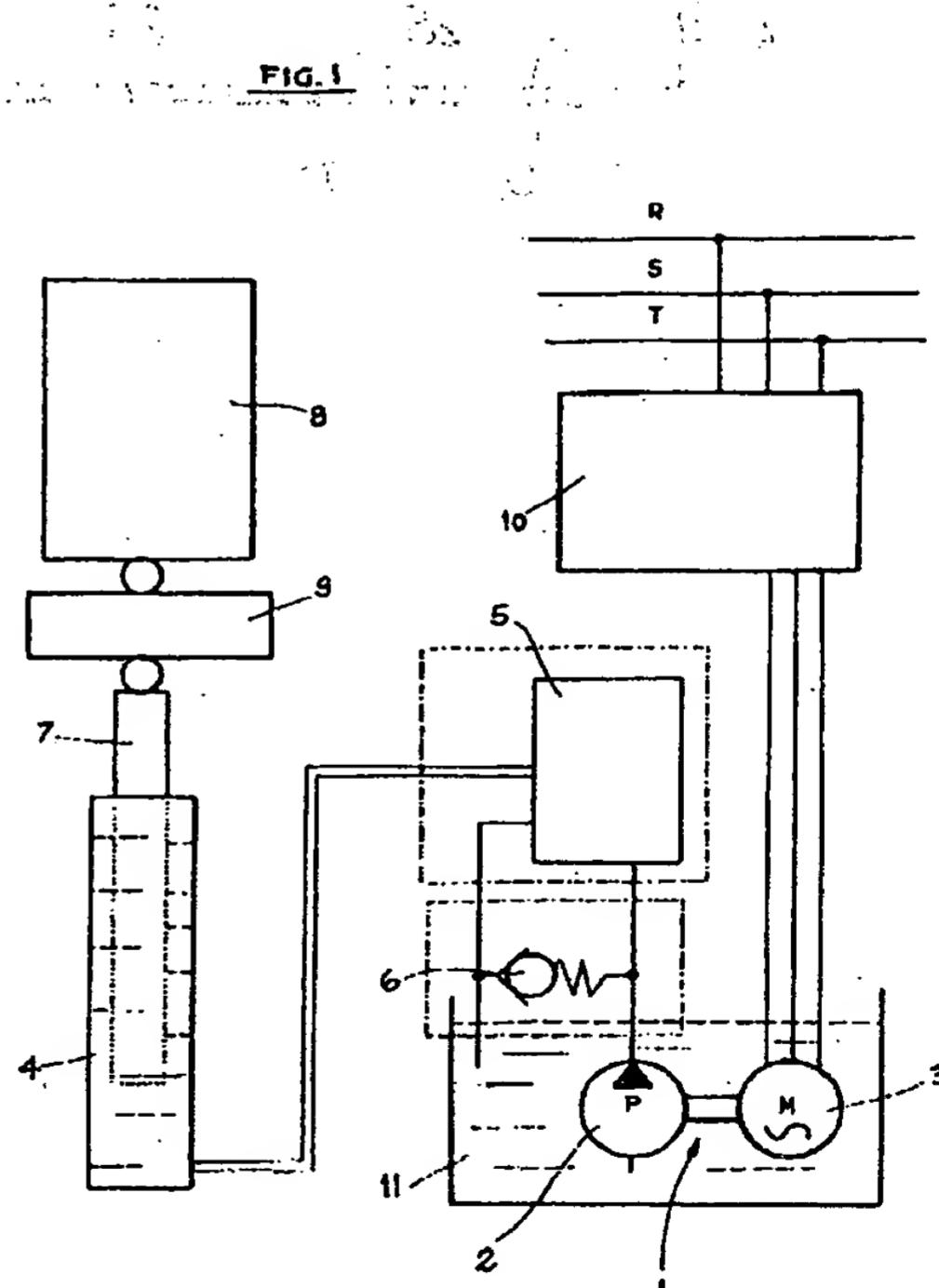
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**(54) Energy recovery drive and control device for the down ride phase of electrohydraulic working lifts**

(57) In down ride phases of electrohydraulic drive lifts, the motor-driven pump unit (1) is caused to rotate in the same or the opposite direction with respect to the one operating in the up ride phases without the help of special electronic devices controlling the motor (allowing or not allowing energy recovery). Having reached the rated speed of the motor-driven pump and the network frequency applied to the motor, the unit carries out a function of brake for the outlet of the operating fluid, causing a pressure that sustains the hydraulic circuit and the closing of valve (6) for the connection to pump (2).

In this way a non electronic control is obtained of the down ride speed by electric motor (3) and of motor-driven pump (2). In such conditions, the electric motor can operate as a generator, possibly giving back energy to the feed line. Such action allows to obtain also a drastic reduction in temperature increase of the operating fluid.



## Description

The invention relates to an energy recovery drive and control device for the down ride phase of conventional electrohydraulic operation lifts, whose motor is not controlled by specific electronic devices that allow or do not allow energy recovery, substantially constituted of a hydraulic unit comprising drive and control devices, connected with the feed pump that drives lifts, and an electric motor for said pump, which can be caused to rotate in one direction during the up ride phases and in the same or the opposite direction during the down ride phases, independently on the opening condition of the down ride valve.

In down ride phases of lifts, the pump caused to rotate in the same or the opposite direction corresponding to the fixed one and independent, to some extent, on the network load and frequency applied to the motor, a braking action is obtained on the outlet of the operating fluid, and a sustaining pressure is caused in the hydraulic circuit, with closing of the control valve.

Such action allows to control the down ride speed of the lift independently on the load by the motor pump unit which becomes electrogeneous, a possible energy giving back to the feed electric line and a contained temperature increase of the operating fluid.

As is known, the present conventional electrohydraulic working lifts, meaning by this term motors that are not electronically controlled as said above, are generally driven, during the down ride phase, by drive electrovalves that realise specific throttlings which choke the flow of the operating fluid and limit, within pre-fixed values, the down ride speed of the elevator car. However, such systems have some drawbacks.

In particular, said working involves the need of dissipating into heat the energy deriving from the car mass because of the fall height of the same during the down ride phases.

In short, such conditions give rise to unwished energy losses and high temperature increase of the operating fluid.

In the above installations, the energy generated during the down ride phases is unrecoverable, while the temperature of the operating fluid may be brought back to acceptable limits through the application of cooling systems to the hydraulic circuit, or by means of hourly movement limits of the lifts. In any case, these interventions are limitative and little economical.

Object of this invention is to eliminate the above drawbacks. The invention, as is characterised by the claims, solves the problem by means of an energy recovery drive and control device for the down ride of conventional hydraulic operation lifts, in the sense specified several times, through which the following results are obtained: the device as a whole is so configured as to manage the down ride function of the lift through the action of the motor-driven pump; the feed pump of the hydraulic circuit of up/down rides of lifts is provided with

fluid regulation and control means; in the down ride, the pump and the electric motor are caused to rotate in the same or the opposite direction with respect to the usual up ride direction, at the same rated speed and network frequency; on such conditions, the possible excess energy derived from the free down ride of cars is transformed into electric energy than can be discharged onto the network or be re-utilisable for other possible users by the motor dragged by the pump and operating as a generator.

The advantages obtained by this invention consist essentially in that, with limited and economical interventions related to the application of drive and control mechanisms on the pump, and a maintenance or inversion controls of the rotatory direction of the motor-driven pump group, it is possible to recover the possible excess energy produced by the mass of cars because of the fall height of the same during the down ride phases, bringing it back directly to the network or exploiting it for the running of auxiliary apparatuses and/or other utilisations.

Another advantages lies in that the excess fluid that discharges into the tank after having produced the possible recoverable energy, undergoes a very limited heating, whose elimination takes place naturally, without the presence of cooling devices and/or time running schedules.

The invention is described in details in the following according to embodiments provided only by way of non-limitative examples, with reference to the attached drawings, wherein:

Figure 1 shows the general diagram of a drive and control device configured according to the functional logic of inversion of the rotatory direction of the motor-driven pump unit, during the down ride of the lift;

Figure 2 shows the general diagram of a second drive and control device, configured according to the functional logic of maintenance of the rotatory direction of the motor-driven pump unit, during the down ride phase of the lift, equal to the one of the up ride phase;

The figures represent possible energy recovery drive and control devices for the down ride of hydraulic operation lifts. In the case in point, there are described, by way of non limitative example, two systems provided with motor-driven pump (1), constant capacity displacement pump (2) and electric motor (3) of the three-phase asynchronous type.

As can be noticed, the apparatuses chosen, for instance, refer to the commonest configuration marketed; however, it is evident that other solutions, with pumps and/or motors of a different type and suitably adapted may be used within the scope of the invention, to obtain the same aim.

With reference to Figure 1, the motor-driven pump unit (1) is associated to a hydraulic piston (4) through a feed valve (5) and a control valve (6). The sliding part (7) of the hydraulic piston (4) engages with a car (8) through conventional connecting means.

In the up ride phase of car (8), the system operates substantially in the conventional manner: through the control board (10) the user presses the up ride button, obtaining in this way the start of the electric motor (3), for instance producing the excitation with RTS contacts.

The operating fluid is pumped from tank (11) to piston (4), the sliding part (7) is upwards pushed and car (8) lifts.

On the contrary, in the down ride phases, the system involves the control valve (6), connected to the drive pump (2). The pressing of the down ride button located on the control board causes the counter-rotation start of the motor-driven pump (1) independently on the opening conditions of the down ride valve (5). The down ride button causes, compared with the up ride one, a contrary excitation, for instance with RTS contact.

Alternatively, motor (3) may be started directly or through a star-delta start circuit, or also through tension variation circuits, without affecting the movement condition of car (8).

Once the rated speed of the system is reached that derives from the displacement of pump (2) at the network frequency applied to motor (3), the latter, being of the asynchronous type, starts developing a braking function due to the discharge of the operating fluid, which causes a pressure of sustaining thrust in the hydraulic circuit and the closing of the control valve (6).

The above conditions allow to obtain the following results:

- control of the down ride speed of car (8) by motor (3);
- possible giving back of electric energy to the network or other possible users, by motor (3), which operates as a generator under the action of the excess load derived from car (8) which tends towards descending groundwards by gravity;
- drastic limitation of temperature increase of the operating fluid thanks to the counter-rotation action of the pump, which discharges it directly into tank (11), without lamination effects due to flow chokings and/or throttlings.

The possible electric energy given back by the motor-generator may be given back to the feed network to be economically exploited during the up ride phases of car (8) or, alternatively, it may be utilised by other users.

Figure 2 shows a different solution of the drive and control device for the down ride phases of electrohydraulic operation lifts, wherein the motor-driven pump (1) keeps the same rotation direction both in the up and the down drives. Pump (2) is connected to exchange

electrovalves (12, 13, 14), which, located according to the shown configuration, allow the controlled discharging of the fluid into tank (11), during the down ride phase of the lift, produced by the braking action of the motor-driven pump unit (1) which operates on the same conditions of rotation direction and network frequency adopted during the up ride phases.

Also in this case, the working of electrovalves (12, 13, 14) is caused by pressing the down ride button located on the control board (10).

In the down ride phases, with valves (12, 13, 14) located as shown in Figure 2, the fluid passes from piston (4) to the central valve (15), then through duct (16) of valve (12) and discharges into the tank through valve (13), pump (2) which rotates, and valve (14). By pressing the up ride button, said electrovalves reverse the position of their passage lights (they shift rightwards according to the diagram of Figure 2). Valves (13) and (14) block the passage of the fluid while the passage light (17) of valve (12) connects the delivery of pump (2) with the feed duct (18) of the central valve (15), and therefore of piston (4), pushing the latter upwards.

While the present invention has been described and illustrated according to some embodiments provided by way of non limitative example, those skilled in the art will understand that various changes in the overall configuration, the individual components, the types of pumps and/or motors, the orientations of the structures may be introduced, without exceeding the protection scope of the invention.

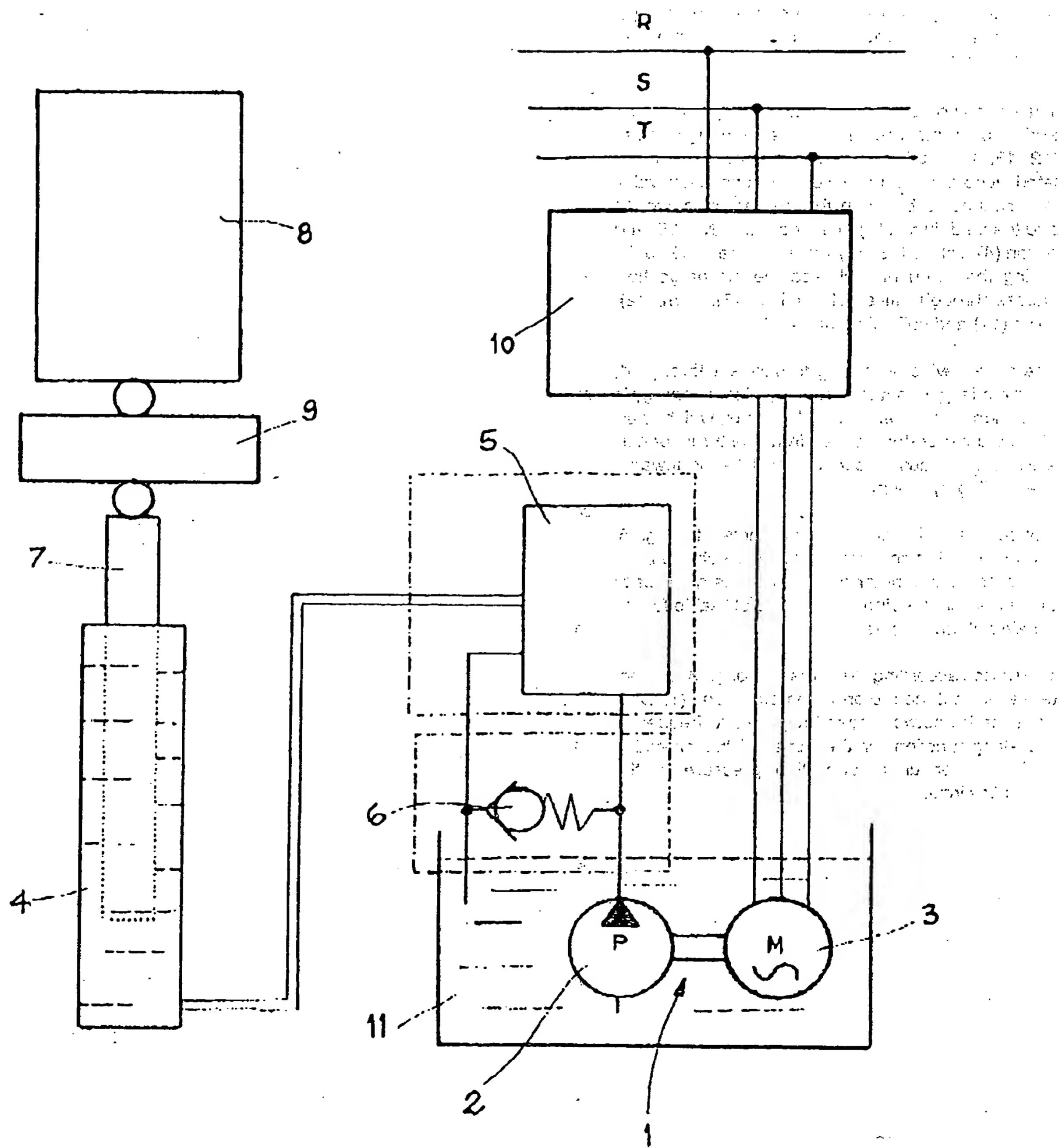
### Claims

1. An energy recovery drive and control device for the down ride phases of conventional electrohydraulic lifts or lifts running without the help of special electronic devices controlling the motor, characterised in that the down ride phases are managed by means of the motor-driven pump unit (1), which is caused to rotate in the same direction or the opposite direction with respect to the rotation of the up ride phases, with a possible energy recovery function.
2. The drive and control device according to claim 1, characterised in that the feed pump (2) of the operating fluid is associated to a control valve (6) and in that the motor-driven pump unit (1), during the down ride phases of the lift is caused to rotate in the opposite direction with respect to that operating during the up ride phases, at rated rotations and frequency, said condition being a braking condition for the operating fluid discharge, for the recovery of the potential energy of the lift in form of electric energy, and limitative for the heating of the same discharged fluid.
3. The drive and control device according to claim 1,

characterised in that feed pump (2) of the operating fluid is associated to exchange electrovalves (12, 13, 14), and in that the motor-driven pump unit (1) during the down ride phases of the lift is caused to rotate in the same direction as the direction of the up ride phases, at rated rotations and frequency; said condition being a braking condition for the operating fluid discharge, for the recovery of the potential energy of the lift in form of electric energy, and limitative for the heating of the same discharged fluid.

4. The drive and control device according to claims 1 and 3, characterised in that the exchange valves (12, 13, 14), during the up ride phases are regulated according to the following conditions: valve (12) connected between the delivery of pump (2) and the feed ducts (18) of the central valve (15) and piston (4), valves (13, 14) with passage block; while during the down ride phases the discharge flow passes through valve (12), valve (13), pump (2), valve (14) and collection tank (11).  
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5. The drive device according to claims 1 through 4, characterised in that the recovery electric energy is a function of the overload on the motor, which operates as a generator, derived from the thrust generated by the mass of car (8) which tends towards down riding by gravity.  
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6. The control device according to claims 1 through 5, characterised in that the recovery electric energy produced by the motor-generator (3) is given back to the network feeding the lift, or is utilisable for the working of other users.  
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7. The device according to claims 1 through 6, characterised in that the motor-driven pump unit (1) exercises, at the network speed regime and frequency, a braking function for the outlet of the operating fluid, with ensuing supporting pressure in the hydraulic circuit.  
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FIG. 1



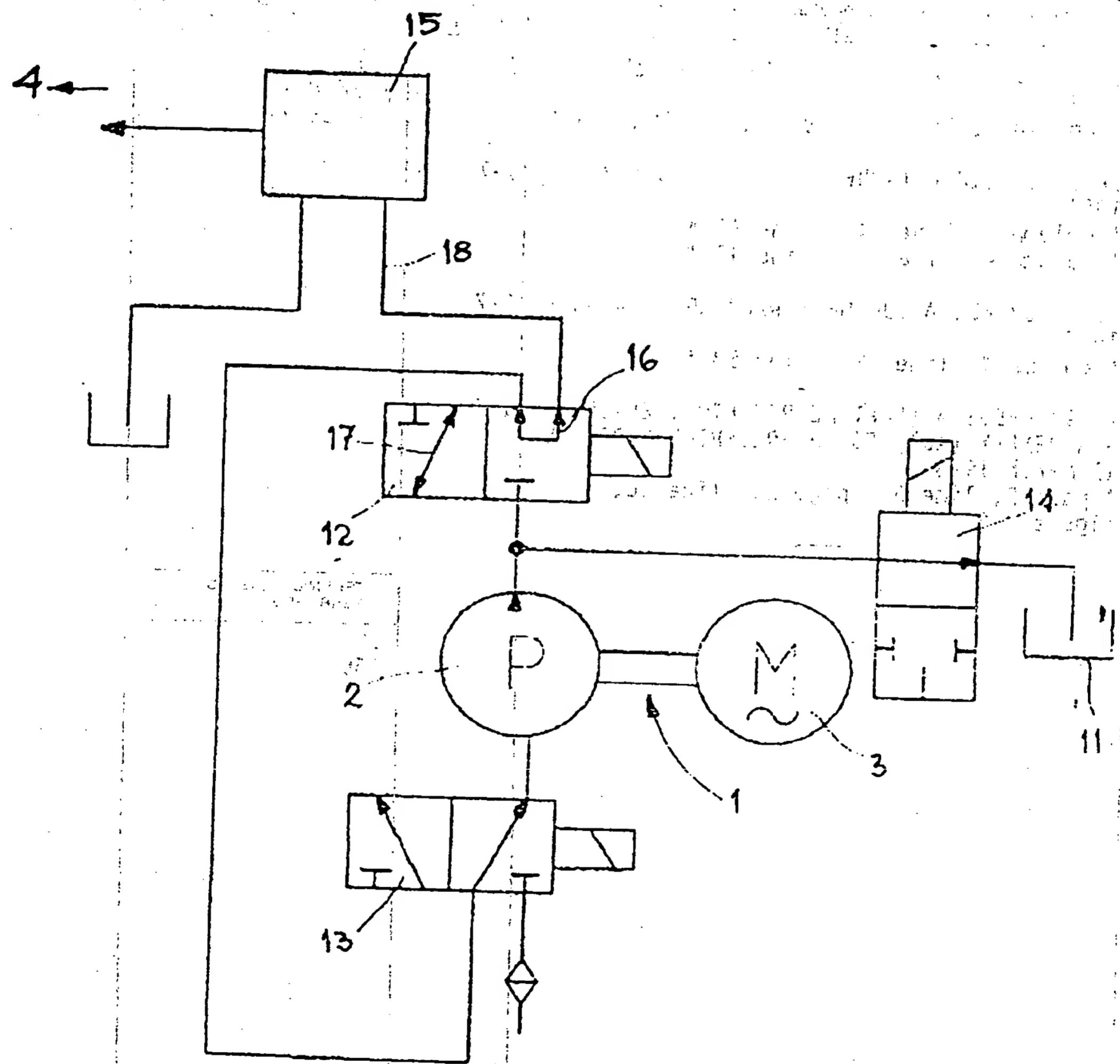


FIG. 2



## EUROPEAN SEARCH REPORT

Application Number  
EP 96 12 0572

DOCUMENTS CONSIDERED TO BE RELEVANT									
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)						
X	US 4 723 107 A (SCHMID MARTIN) 2 February 1988 * column 3, line 40 - column 4, line 39 * ---	1-7	B66B9/04 Y/B66B1/04, B66B1/24						
X	DE 38 36 212 A (KONE ELEVATOR GMBH) 24 May 1989 * column 2, line 14 - line 37 * * column 4, line 43 - line 47 * ---	1-7							
X	DE 44 02 653 A (JUNGHEINRICH AG) 3 August 1995 * column 4, line 52 - line 58 * ---	1-7							
A	WO 94 05583 A (CAPTINE PTY LTD ; PERKINS REX HENLEY (AU); ESSEN FREDERICK HUBERT V) 17 March 1994 * page 9, line 5 - page 10, line 10; figure 8 *	1-7							
TECHNICAL FIELDS SEARCHED (Int.Cl.6)									
B66B B66F									
<p>The present search report has been drawn up for all claims</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Place of search</td> <td style="width: 33%;">Date of completion of the search</td> <td style="width: 34%;">Examiner</td> </tr> <tr> <td>THE HAGUE</td> <td>28 October 1997</td> <td>Sozzi, R</td> </tr> </table>				Place of search	Date of completion of the search	Examiner	THE HAGUE	28 October 1997	Sozzi, R
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CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document							
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